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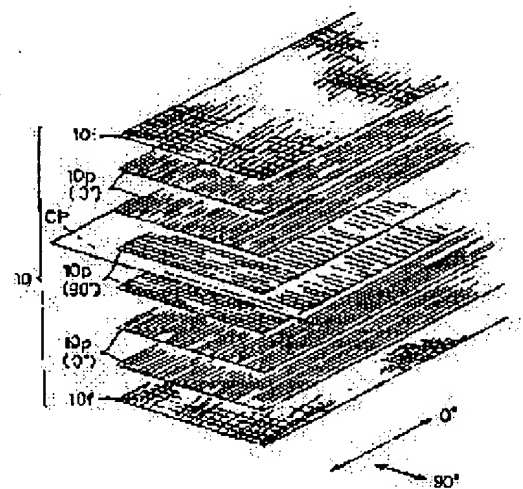
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(54) SEMICONDUCTOR CARRYING ARM

(57)Abstract:

PROBLEM TO BE SOLVED: To improve strength and vibration attenuation characteristics regardless of small size and weight by composing a semiconductor carrying arm of a laminated material containing a double-layered carbon fiber prepreg where a carbon fiber with at least a specific tension modulus of elasticity is hardened with a resin material.

SOLUTION: A semiconductor carrying arm 10 is composed of a carbon fiber prepreg 10p where a carbon fiber whose tension strength is at least 400 GPa is aligned and is hardened with a synthetic resin, and the complex of a cloth prepreg 10f where the cloth of carbon fiber is hardened with the synthetic resin similarly. More specifically, one carbon fiber prepreg 10p in the direction of 90° and two carbon fiber prepreg 10p in the direction of 0° are overlapped in mirror symmetry in reference to a center surface CP in the thickness direction of the semiconductor carrying arm 10. Further, a cloth prepreg 10f is overlapped on them, and they are heated and connected to compose the semiconductor carrying arm 10.



fiber prepreg

no single carbon fiber

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CLAIMS

[Claim(s)]

[Claim 1] The semiconductor conveyance arm characterized by the bird clapper in the semiconductor conveyance arm to which put conveyance objects, such as a semiconductor wafer, and it is made to move from the plywood which hardened the carbon fiber of 400 or more GPas of moduli of elasticity in tension with resin material, and which contains the carbon fiber prepreg of a bilayer at least.

[Claim 2] Plywood is a semiconductor conveyance arm containing two or more carbon fiber prepregs from which the direction of fiber differs in a semiconductor conveyance arm according to claim 1.

[Claim 3] It is the semiconductor conveyance arm whose carbon fiber is a carbon fiber of 600 or more GPas of moduli of elasticity in tension in a semiconductor conveyance arm claim 1 or given in two.

[Claim 4] It is the semiconductor conveyance arm whose carbon fiber is a pitch based carbon fiber in the semiconductor conveyance arm of three claim 1 or given in any 1 term.

[Claim 5] Two or more carbon fiber prepregs are semiconductor conveyance arms with which the above 0-degree prepreg and the carbon fiber were further suitable in the direction of a conveyance load arm and the direction which intersects perpendicularly which the carbon fiber turned to in the direction of a conveyance load arm in the claim 2 or the semiconductor conveyance arm of three given in any 1 term and which contain the above 90-degree prepreg further.

[Claim 6] It is the semiconductor conveyance arm with which 90-degree prepreg is located in the core of the thickness direction of plywood, and 0-degree prepreg is located in the rim section of the thickness direction in a semiconductor conveyance arm according to claim 5.

[Claim 7] It is the semiconductor conveyance arm with which mirror arrangement of two or more carbon fiber prepregs is carried out about the longitudinal plane of symmetry of the thickness direction of plywood in the claim 2 or the semiconductor conveyance arm of six given in any 1 term.

[Claim 8] The semiconductor conveyance arm with which the laminating of the prepreg of the cloth of a carbon fiber or a nonwoven fabric is further carried out to the outermost marginal part in the semiconductor conveyance arm according to claim 7.

[Claim 9] The semiconductor conveyance arm with which resin paint is given to the processing side of plywood in the semiconductor conveyance arm of a claim 1 given in any 1 term.

[Claim 10] It is the semiconductor conveyance arm whose thickness of plywood is 3.2mm or less in a claim 1 or the semiconductor conveyance arm of nine given in any 1 term.

[Claim 11] The semiconductor conveyance arm with which the conveyance object contact base which becomes the contact section with a conveyance object from engineering plastics is stuck on the surface of plywood in the claim 1 or the semiconductor conveyance arm of ten given in any 1 term.

[Claim 12] It is the semiconductor conveyance arm whose engineering plastics are PEEK, and PI, PAI, PBI or PEI in a semiconductor conveyance arm according to claim 11.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention relates to the semiconductor conveyance arm used in case conveyance objects, such as a semiconductor wafer, are conveyed with a robot in a semiconductor manufacturing process.

[0002]

[Description of the Prior Art] In the manufacturing process of a semiconductor, conveyance objects, such as a semiconductor wafer, are conveyed with a robot in a clean room. The robot has the main part, the plat form, the arm, and the end effector, and the conveyance arm which carries and conveys a conveyance object to this end effector is fixed. This semiconductor conveyance arm was rich in periodic-damping nature with lightweight small and high intensity for prevention of a robot's miniaturization, exact conveyance of a conveyance object, the formation of a ** space, and raising dust etc., it was called for that they are low dusting characteristics further, and metals, such as an aluminum containing alloy and stainless steel, or ceramic material has been used conventionally. However, a diameter is enlarging the semiconductor wafer which should be conveyed from 8 inches to 12 inches (300mm), and a miniaturization, and high intensity and periodic-damping nature are becoming an antinomy-demand with the quality of the material of the conventional semiconductor conveyance arm.

[0003]

[Objects of the Invention] this invention -- therefore, small -- though it is lightweight, it aims at obtaining the semiconductor conveyance arm which was excellent in high intensity at periodic-damping nature

[0004]

[Summary of the Invention] having the periodic-damping nature which was excellent in high intensity though the prepreg to which this invention person hardened the specific carbon fiber of the high intensity high elasticity among carbon fibers with resin material was lightweight -- paying one's attention -- this carbon fiber prepreg -- using -- small -- though it is lightweight, it excels in high intensity at periodic-damping nature, and succeeds in obtaining the semiconductor conveyance arm with which are satisfied of the demand of further low dusting characteristics

[0005] this invention is characterized by constituting the semiconductor conveyance arm to which put conveyance objects, such as a semiconductor wafer, and it is made to move from plywood which hardened the carbon fiber of 400 or more GPas of moduli of elasticity in tension with resin material and which contains the carbon fiber prepreg of a bilayer at least.

[0006] As for the plywood which constitutes a semiconductor conveyance arm, it is desirable to include two or more carbon fiber prepregs from which the direction of fiber differs. Moreover, the carbon fiber which constitutes a prepreg is more lightweight in a modulus of elasticity in tension being 600 or more GPas more preferably, and the semiconductor conveyance arm of high intensity is obtained. Furthermore, although a pitch system and pan ** are known by the carbon fiber, a pitch system is desirable [a system], in order that a pitch system may be excellent in periodic-damping nature compared with pan ** and the thing of 600 or more GPas may tend to obtain [a modulus of elasticity in tension] it.

[0007] When 90-degree prepreg more than the monostromatic by which it was suitable in the above 0-degree prepreg and the direction in which the direction of a conveyance load arm and a carbon fiber cross at right angles which the carbon fiber turned to in the direction of a conveyance load arm is further included in two or more carbon fiber prepregs which constitute plywood, it is desirable on intensity. In this case, 90-degree prepreg is located in the core of the thickness direction of plywood, and if 0-degree prepreg is located in the rim section of the thickness direction, flexural rigidity will tend to obtain it. As for two or more carbon fiber prepregs, it is good to carry out mirror arrangement about the longitudinal plane of symmetry of the thickness direction of plywood so that the exception of the front reverse side may not arise.

[0008] In the outermost marginal part of plywood, it is desirable to carry out the laminating of the prepreg of the cloth of a carbon fiber or a nonwoven fabric. The prepreg of cloth or a nonwoven fabric has a good precision of the processing section, when it is compared and processed into 0-degree prepreg or 90-degree prepreg. In order to prevent raising dust more certainly, it is desirable to give resin paint to the processing side of plywood.

[0009] Mechanical strength with the thickness of the semiconductor conveyance arm by this invention sufficient also as 3.2mm or less and periodic-damping nature are obtained. 3. Even if it exceeds 2 mm, an improvement significant to intensity or periodic-damping nature is not found, but the problem of heavy-gage-izing (enlargement) produces it rather.

[0010] It is desirable to stick the conveyance object contact base which becomes the contact section with a conveyance object from engineering plastics on the surface of plywood. Specifically, PEEK, and PI, PAI, PBI or PEI can be used as engineering

plastics.

[0011]

[The operation gestalt of invention] Drawing 1 or drawing 3 shows the example of an appearance configuration of the semiconductor conveyance arm 10 by this invention. This semiconductor conveyance arm 10 consists of plywood which hardened the carbon fiber of 400 or more GPa's of moduli of elasticity in tension with resin material and which contains the carbon fiber prepreg of a bilayer at least, and the base 11 is fixed to a robot's end effector 21. Two crotches 12 are formed in the point of the semiconductor conveyance arm 10, and adhesion fixation of the conveyance object contact base 22 is carried out on these two crotches 12, respectively. Moreover, one conveyance object contact base 23 is being fixed to the pars intermedia of the length direction of the semiconductor conveyance arm 10, and the semiconductor wafer 30 is laid on the conveyance object contact base 22 which defines these a total of three flat surface [one], and 23. Step 22a which prevents slipping down of the semiconductor wafer 30 is formed in the conveyance object contact base 22.

[0012] Drawing 4 is the concrete operation gestalt of the laminated structure of the semiconductor conveyance arm 10. This semiconductor conveyance arm 10 is carbon fiber prepreg 10p which tensile strength aligned the carbon fiber (the about diameter of fiber, for example, 10 micrometers) of 400 or more GPa's, and hardened by synthetic resin from the cloth prepreg 10f complex which hardened the cloth of a carbon fiber by synthetic resin similarly. The tensile strength of the carbon fiber which constitutes cloth prepreg 10f is good at 1/10 or less [of that of the carbon fiber which constitutes carbon fiber prepreg 10p]. A cloth prepreg is replaceable with a nonwoven fabric prepreg.

[0013] If the direction which intersects perpendicularly the length direction of the semiconductor conveyance arm 10 with the direction of 0 degree and the length direction is now made into the direction of 90 degree It is related with the longitudinal plane of symmetry CP of the thickness direction of the semiconductor conveyance arm 10. carbon fiber prepreg 10p (90 degrees) of the direction of 90 degree to the mirror symmetry One sheet, Two carbon fiber prepreg 10p (0 degree) of the direction of 0 degree is piled up, further, on it, heating combination of these is carried out for cloth prepreg 10f in piles, and the semiconductor conveyance arm 10 is constituted. The number of laminatings (the number of plies) can be arbitrarily set up according to elements, such as a size of the carbon fiber to be used, and thickness of carbon fiber prepreg 10p.

[0014] Thus, the semiconductor conveyance arm 10 with intensity required for the length direction and the cross direction can be obtained by kneading carbon fiber prepreg 10p (0 degree) and carbon fiber prepreg 10p (90 degrees) several-fold necessary ply. And if it arranges to the mirror symmetry, the semiconductor conveyance arm 10 excellent in the flexural rigidity of the length direction will be obtained by there being no front reverse side in the semiconductor conveyance arm 10, and arranging carbon fiber prepreg 10p (90 degrees) to a core, and arranging carbon fiber prepreg 10p (0 degree) in the rim section. Cloth prepreg 10f of the maximum outside, when processing it into the semiconductor conveyance arm 10, it is effective in order to raise a process tolerance. It is desirable to paint by resin material in the cutting processing side 14 and ***** processing side of a periphery of the semiconductor conveyance arm 10, and to prevent raising dust certainly to them.

[0015] As for the carbon fiber which constitutes carbon fiber prepreg 10p, the thing of 400 or more GPa's is chosen for the modulus of elasticity in tension as mentioned above. It is good more preferably to choose the pitch based carbon fiber of 600 or more GPa's of moduli of elasticity in tension.

[0016] The conveyance object contact bases 22 and 23 are formed a total of three points on the semiconductor conveyance arm 10, in order to reduce a touch area with the semiconductor wafer 30. As for these conveyance object contact bases 22 and 23, constituting from engineering plastics is desirable because of injury prevention of a semiconductor wafer and raising dust prevention. As engineering plastics, PEEK, and PI, PAI, PBI or PEI can be used at least.

[0017] Next, the concrete example of manufacture is explained. On the other hand, the modulus of elasticity in tension arranged the pitch based carbon fiber ("diamond lead" hy-E25M65D (tradename) Mitsubishi Chemical make) of 600GPa(s) in **, and created epoxy prepreg 10p of 0.25mm ** by the epoxy resin. Epoxy prepreg 10p (90 degrees) is made the mirror symmetry for this epoxy prepreg 10p, the laminating of the two sheets is made for one sheet and epoxy prepreg 10p (0 degree), and the modulus of elasticity in tension heated this layered product on the front face for 3 hours, and made it to have carried out the laminating of the cloth prepreg 10f which carried out the plain weave of the pan ** carbon fiber of 23GPa(s) by the hand lay up / the vacuum bag method, and harden it 140 degrees C under 5 kgf/cm² air pressurization This layered product was cut and ***** processed at drawing 1 or a configuration like drawing 3 , and the processing side was painted by the epoxy resin (sealing processing). Thus, the conveyance object contact bases 22 and 23 which consist of IMIDA SOL system engineering plastics were fixed to the front face of the obtained semiconductor conveyance arm 10 with the epoxy adhesive. The sizes a and b of drawing 2 were 360mm and 170mm, respectively.

[0018] When the thickness of the semiconductor conveyance arm 10 manufactured as mentioned above, the weight, and the damping ratio were measured, it was as in Table 1. As an example of comparison, the semiconductor conveyance arm of the product made from an aluminum containing alloy and the product made from stainless steel is created with the same size as drawing 2 , and the numeric value which measured thickness, the weight, and the damping ratio similarly is shown in this **. A damping ratio shows that an attenuation performance is so high that a number is large.

[0019]

[Table 1]

Example article Product made from an aluminum containing alloy Thickness made from stainless steel (mm) 2.2 3.0 3.0 weights (g) 138 295 840 damping ratios 68x10⁻³ 9.1x10⁻³ 5.5x10⁻³ [0020] Even if the example article of this invention made thickness and the weight small notably as compared with the example of comparison so that clearly from Table 1, it was checked that the

damping ratio is conventionally superior to elegance.

[0021] The configuration of the semiconductor conveyance arm 10 shown in drawing 1 or drawing 3 does not show an example, and the semiconductor conveyance arm 10 of this invention is not limited to this configuration.

[0022]

[Effect of the Invention] since this invention constituted the semiconductor conveyance arm from plywood using the prepreg which hardened the carbon fiber of 400 or more GPas of moduli of elasticity in tension with resin material among carbon fibers which contains the carbon fiber prepreg of a bilayer at least -- half-** -- small -- though it is lightweight, the semiconductor conveyance arm which was excellent in high intensity at periodic-damping nature can be obtained

[Translation done.]